Disruptive Science & Technology

Taking The Battle To The Enemy

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Report Documentation Page

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Content

Why we invest in S&T, and what are the challenges ?

Examples of S&T exploitation.

Innovation in S&T acquisition.

Questions.

To start …

Proposition #1

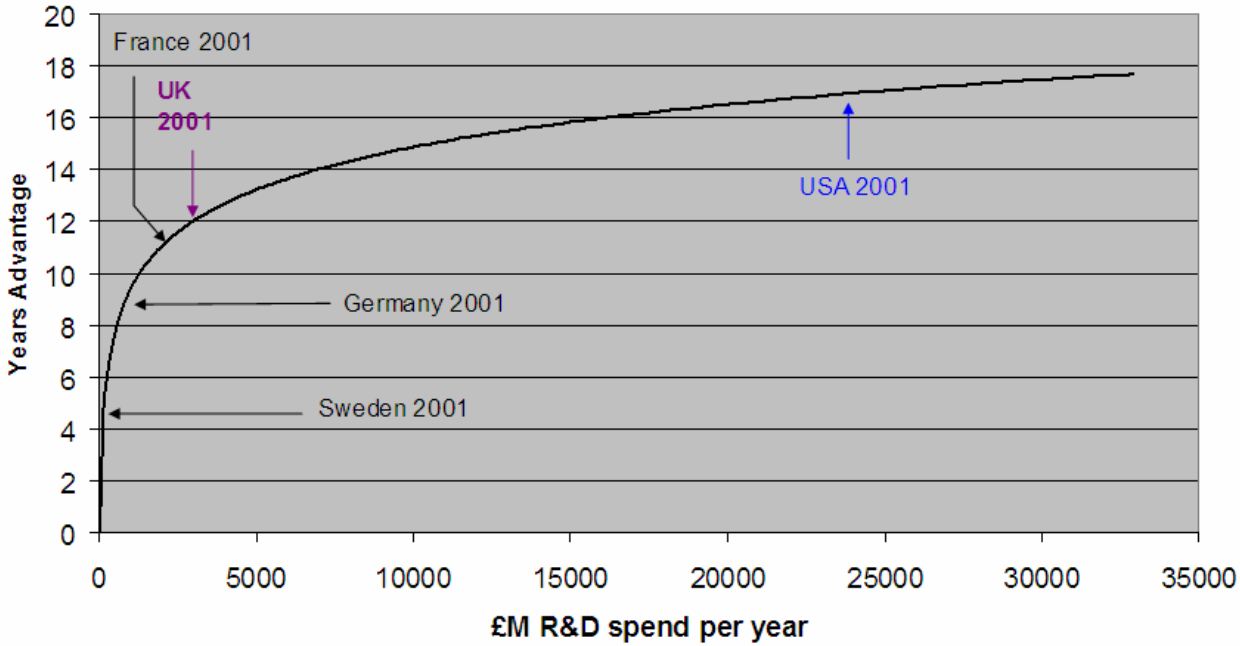
- The only difference between the old equipment and the new is science and technology.

Proposition #2

- Whilst replacing old equipment with new gives incremental advantage, the world's best sword is no match for the smart munition.

Proposition #3

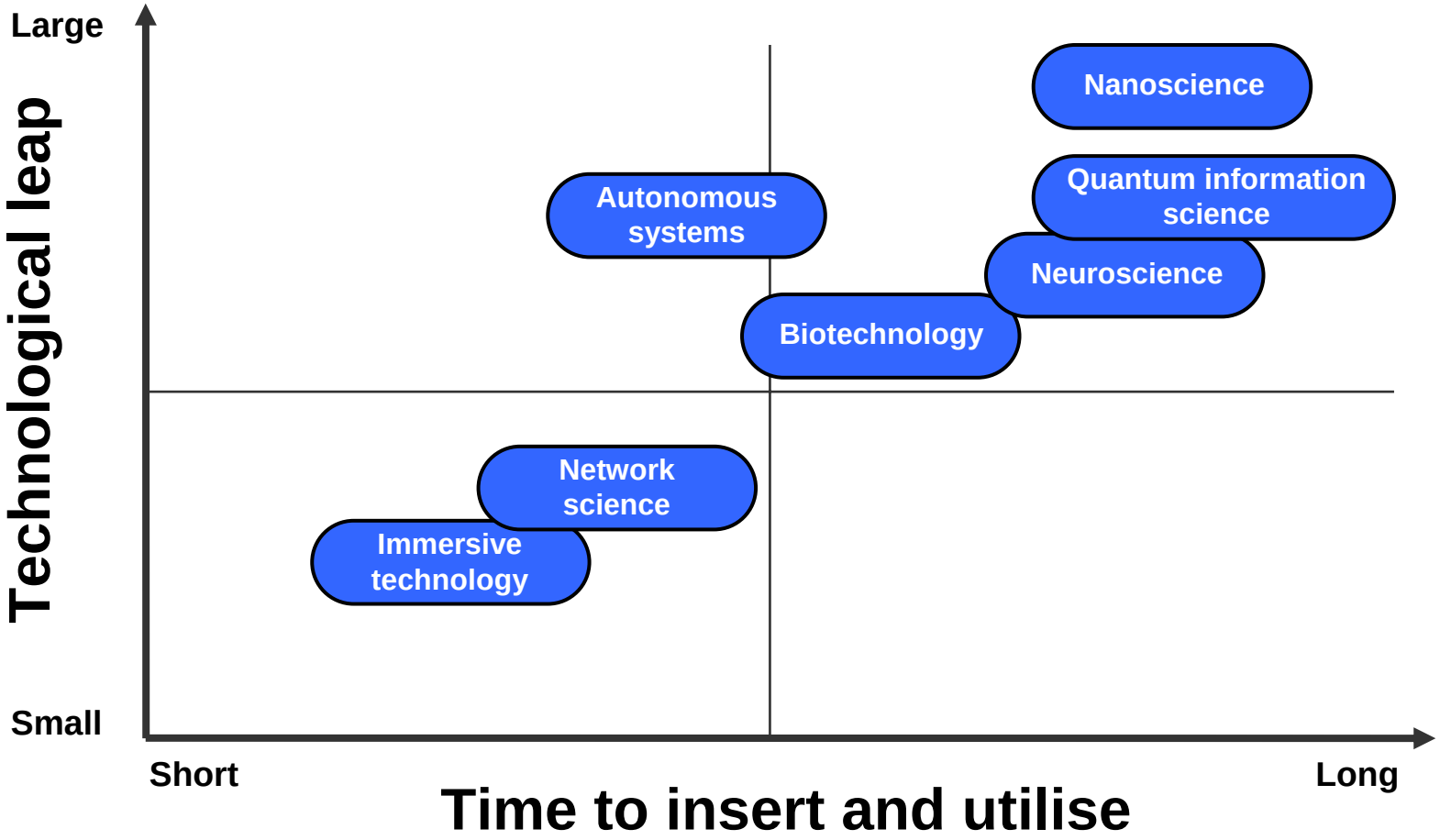
- Equipment advantage (based on new S&T) only buys you time. An agile, determined and capable enemy will close the gap.



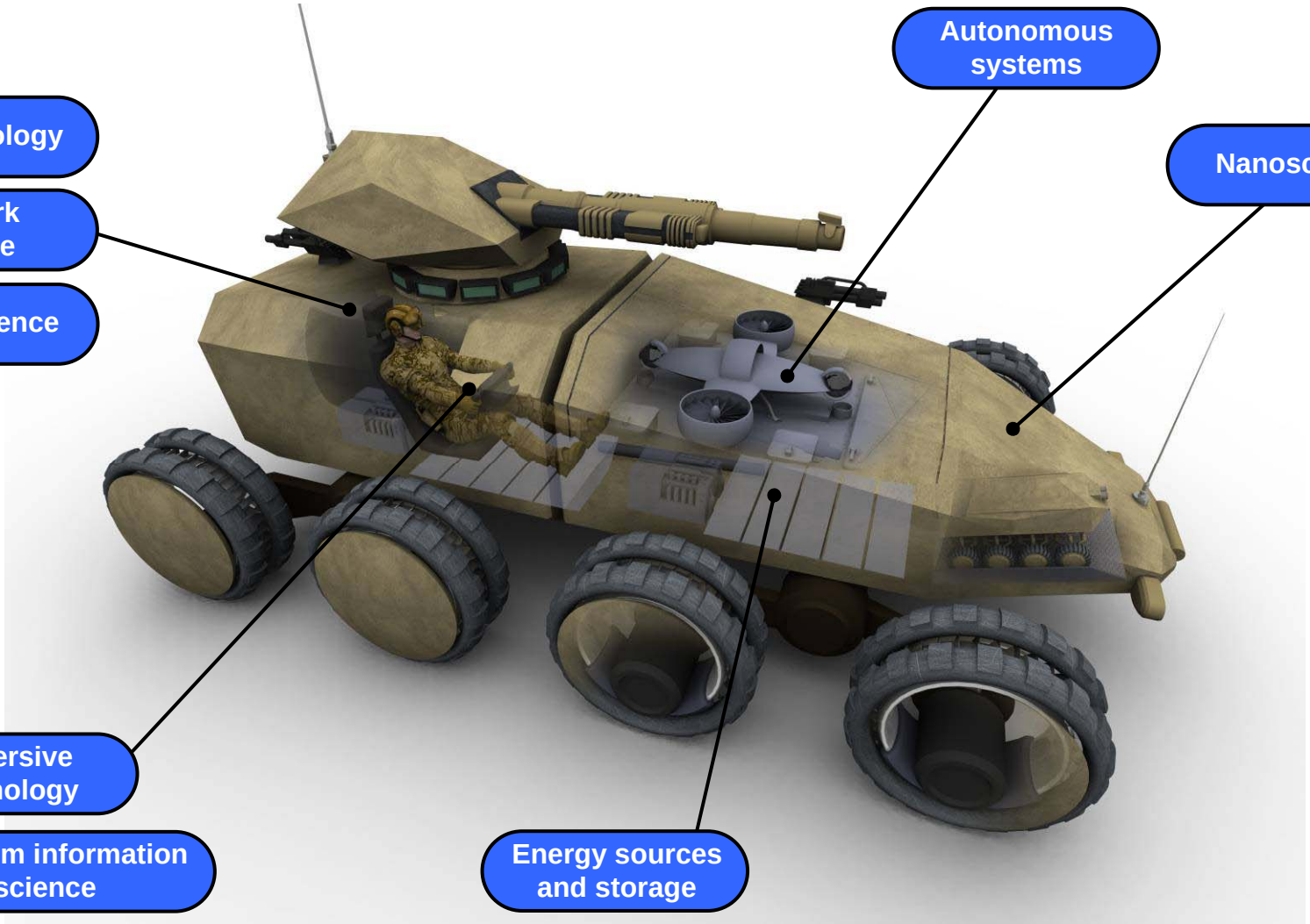
The Effect of Defence R&D on Military Equipment Quality
Middleton, Bowns, Hartley, Reid
Defence and Peace Economics, 17(2), Apr 2006

Technological Superiority

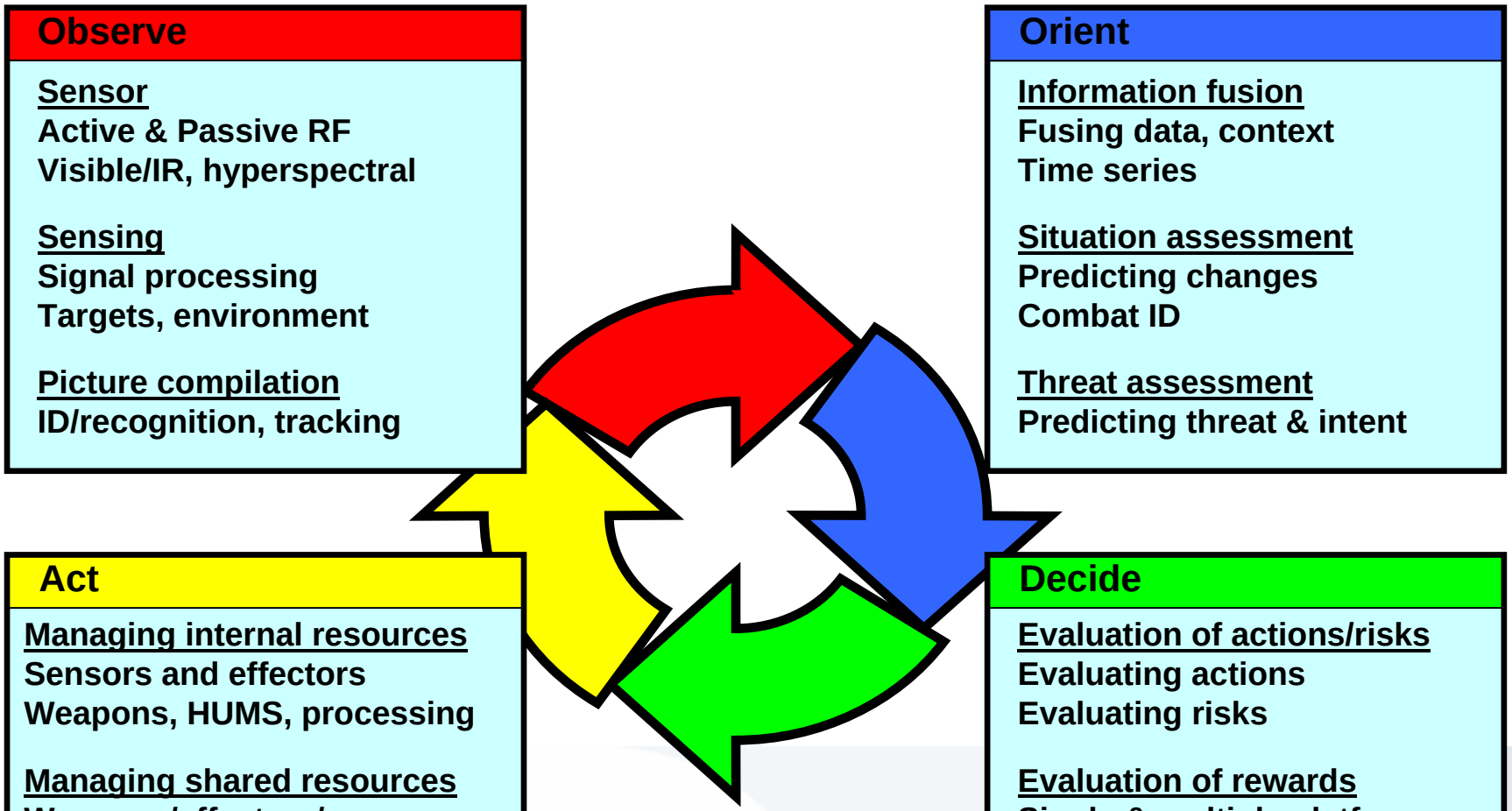
Example Technologies



Example Technologies

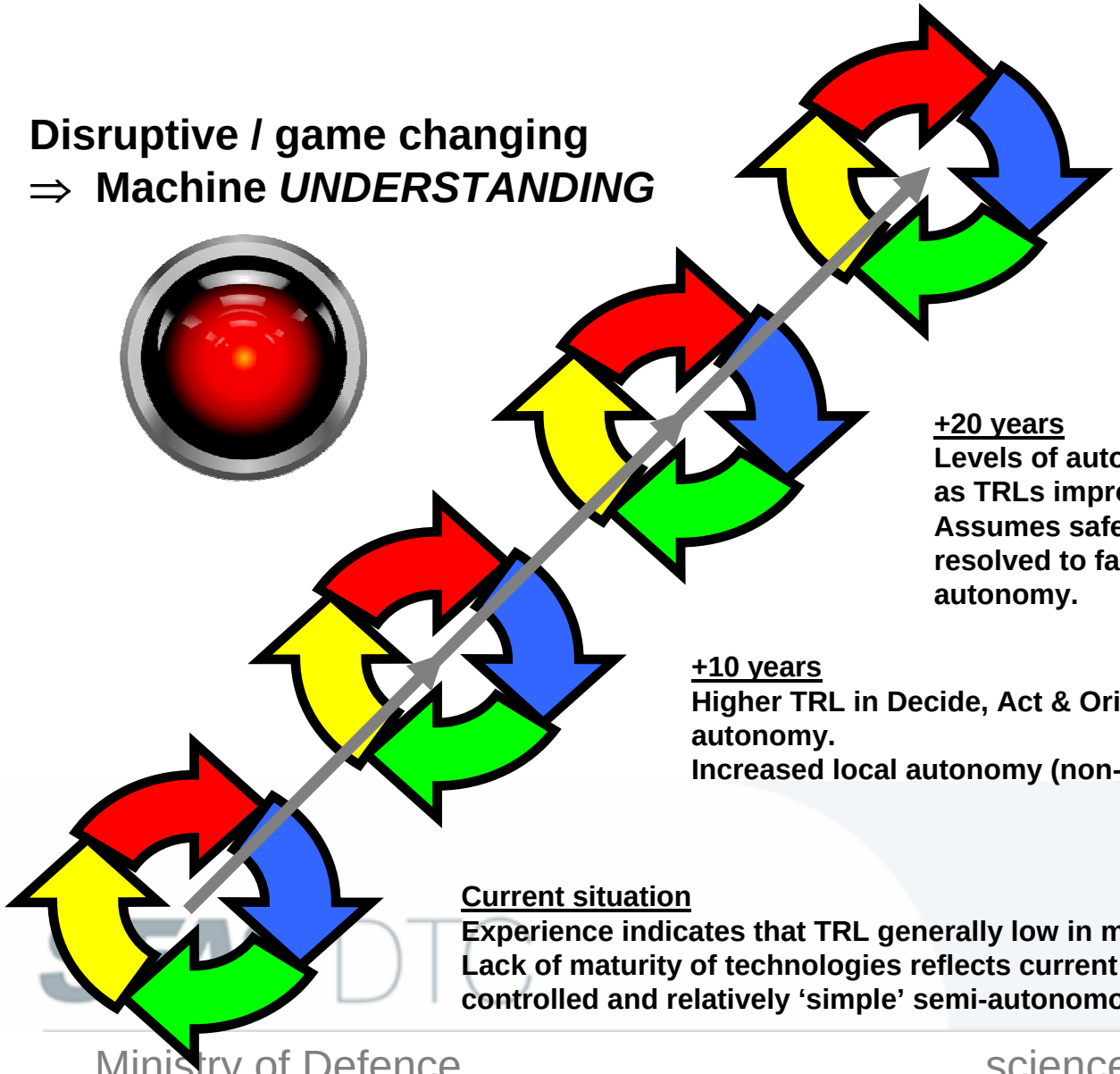


Autonomy in the Land Domain



An Autonomy Roadmap

Disruptive / game changing
⇒ Machine *UNDERSTANDING*



<u>+30 years</u>
High TRLs achieved in most areas.
Significant levels of autonomy should to be achievable at this time.

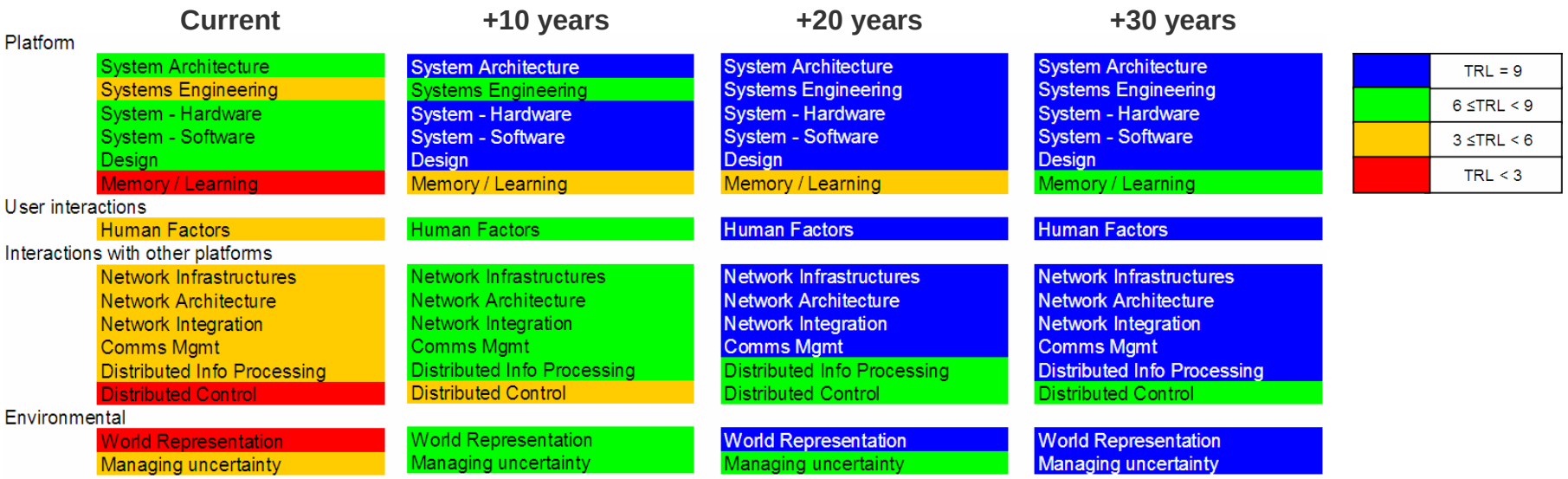
<u>+20 years</u>
Levels of autonomous decision making increased as TRLs improve across the OODA loop sectors.
Assumes safety and certifications issues resolved to facilitate push towards greater autonomy.

<u>+10 years</u>
Higher TRL in Decide, Act & Orient will enable greater autonomy.
Increased local autonomy (non-critical decision making).

<u>Current situation</u>
Experience indicates that TRL generally low in most areas.
Lack of maturity of technologies reflects current availability of remotely controlled and relatively 'simple' semi-autonomous systems.

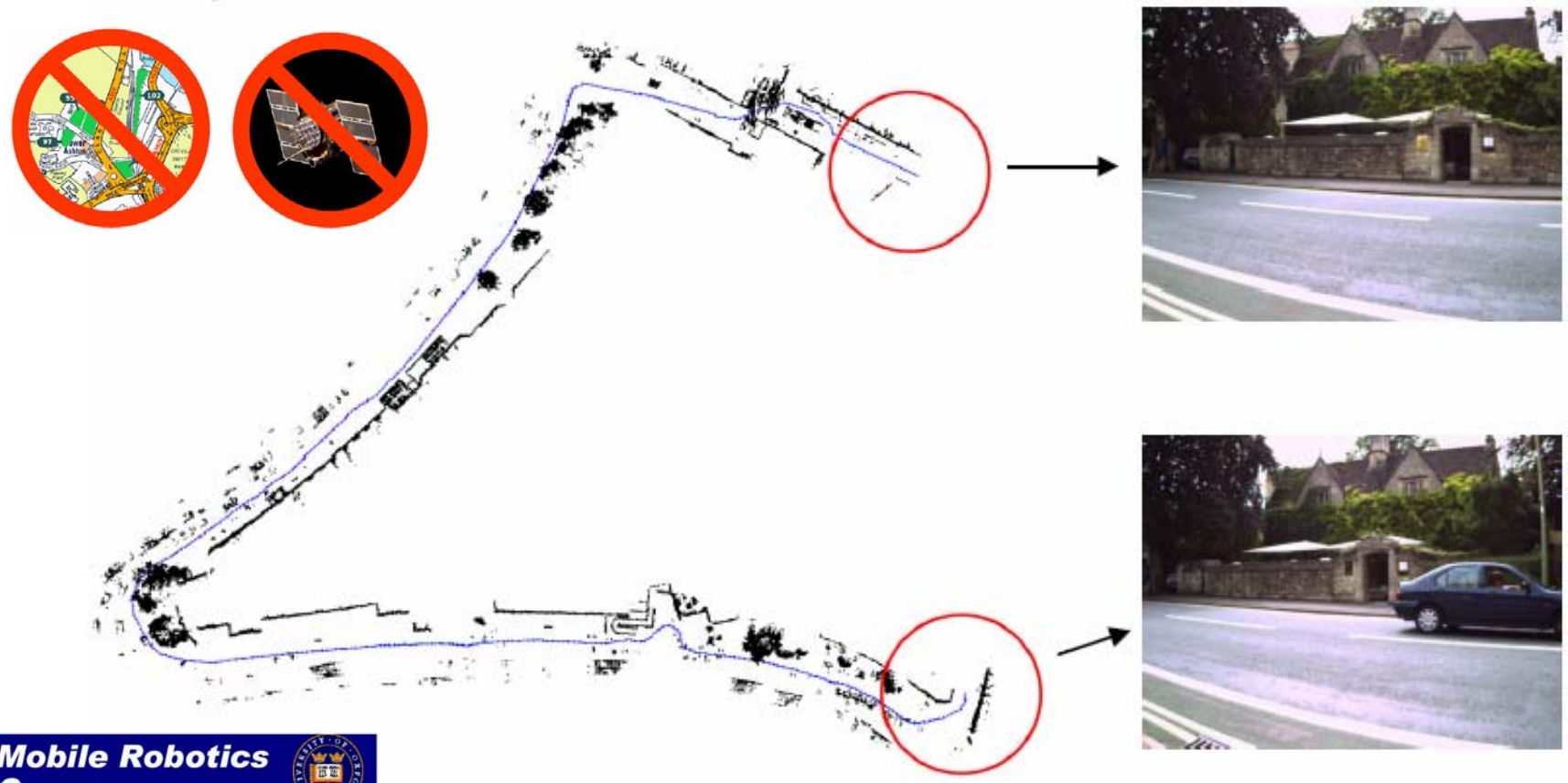
Defence Technology Centres

Autonomy Enablers



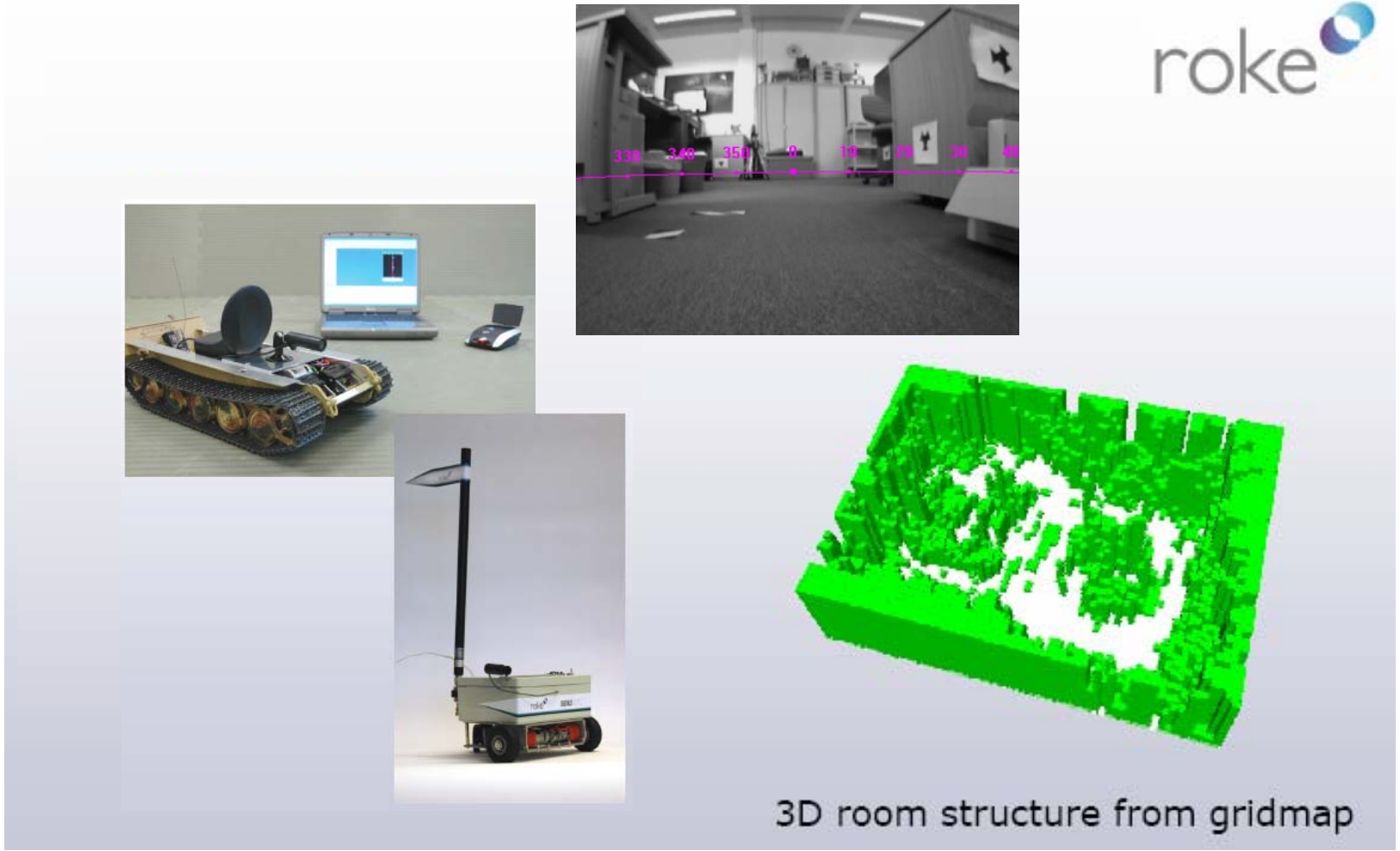
Appearance-Based Mapping & Navigation in Urban Environments

Appearance information can detect loop closure where metric approaches may fail.



Mobile Robotics Group

Autonomous Exploration & Mapping of an Indoor Environment



Armour

- PARSIFAL
  - A programme of UOR activity to improve the protection of a range of armoured vehicles as well as personnel.

Zephyr HALE UAV

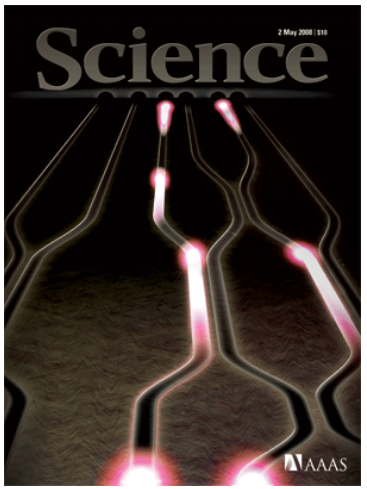
- Yuma Proving Ground, July-August 08
  - UK MOD S&T funding
  - US JCTD funding (OSD AS&C)
    - CENTCOM sponsor, SMDC support
  - Z6.2 airframe: 82½ hrs, 61778ft altitude
  - Z6.1 airframe: 100 hrs
    - Demonstrated 300 mile 2-way comms relay
    - BLOS telecommand over Iridium
- Z6 aircraft met performance predictions
  - Providing flight test data that increases confidence in Z7 aerodynamic modelling and design tools
  - Significant de-risking of Z7 subsystems
    - Power, propulsion and thermal design

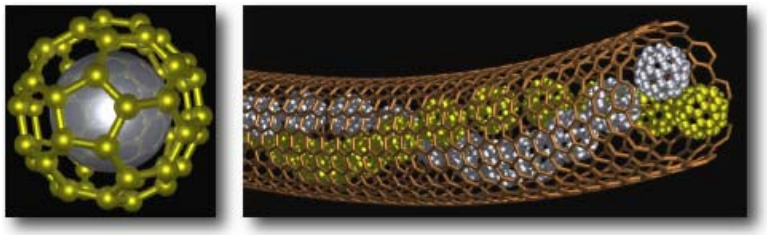
Portable Power

- £5m programme to develop two soldier power sources to TRL 7
- Strand 1: Small, light, low power, high energy density
  - 7.2W (30W peak), 48 hr, 300Wh/kg
  - Reformed methanol fuel cell chosen
    - Partnering with UltraCell
  - Current status
    - 15W fuel cell engine
    - Prototype electronics breadboard designed
- Strand 2: Mid size, lightweight, high power, high energy density
  - 100W (150W peak), 1200 Whr, 333Wh/kg
  - Hydrogen fuel cell with ammonia borane hydrogen store
    - Partnering with Jadoo Power Systems Inc.
  - Current status
    - H2 generator demonstrated peak power 80W at system level
    - System designed

Quantum Information Processing Interdisciplinary Research Collaboration

- QIP IRC is a UK national collaboration involving 10 universities and 5 industries. It started in 2004, and will continue until 2009.
- The scientific goals are:
  - The development of novel approaches for the controlled generation and entanglement of two or more qubits
  - The development of methods for efficient transfer of quantum information between static and propagating qubits
- These objectives include theoretical analysis of new methods of manipulation and transfer between qubits of the same or different types, and also their experimental design and implementation.





Immersive Training

- **Virtual Battlespace (VBS) 2 for pre-deployment training**
  - Player & instructor stations
    - Driver, commander and top gunner
    - Voice over IP or PRR or Motorola communications
  - A number of scenarios including
    - IED & VBIED, ambush (small arms and RPG), civilian crowds, coalition flanking forces
  - Recordable after action review

Blended Live/Synthetic Training

- **A Canadian Study looked at the influence VBS had on their Armour School's Troop Warrant Officers course.**
- **Serial 0702 cost ~ 33% less through reductions in fuel, etc., and drove the pass rate up from 72% to 100% compared to purely live training.**
- **Only one day of VBS took the pass rate to 30%.**
- **The new blended live/simulation mix reduced the cost to train (and qualify) each trainee by about a half.**

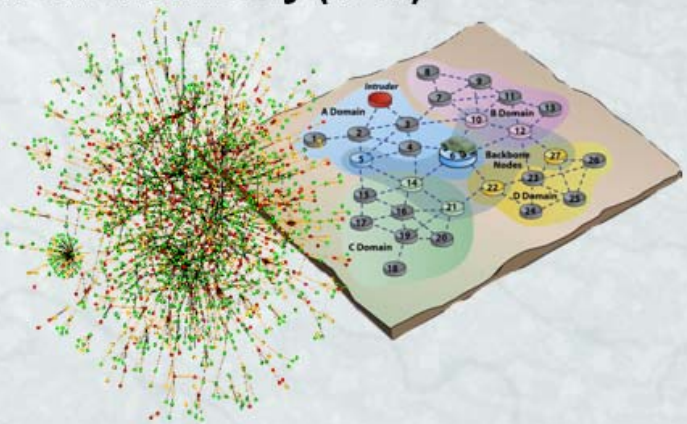
	Serial 0602 (No VBS®)	Serial 0701 (1 day VBS®)	Serial 0702 (2.5 weeks VBS®)
% pass on 1st trace	0	30%	67%
% pass by ½ of traces	61%	72%	100%
% pass by end of course	72%	83%	100%

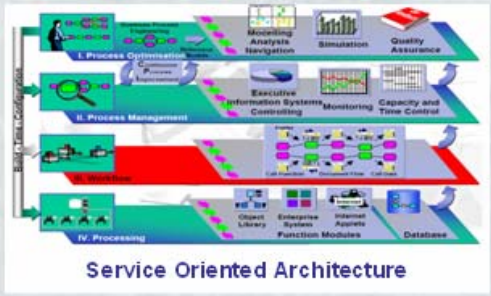
Figure 5: VBS 2® Workstations in the Armour School Battle Lab (Hill 2008)

I/ITSEC Conference 2008 Paper
Games – Just How Serious Are They ?
Dr. Paul A. Roman Mr. Doug Brown

The International Technology Alliance

Network Theory (TA1)





Sensor Information Processing and Delivery (TA3)

Security Across a System-of-Systems (TA2)

Distributed Coalition Planning and Decision Making (TA4)

Innovation Strategy

SHARING THE VISION

Defence Technology Plan.

Publish forward looking EP.

ROAD MAPPING

Development of
Technology Road Maps.

NEED FOR SPEED

Standard terms of business to streamline R&D contracting process.

Review Innovative Proposals in Timely Fashion.

SYSTEMS ENGINEERING

Encourage adaptable systems and open architectures where appropriate.

Research Concept Demonstrators.

BUSINESS MODELS

Defence Enterprise Centres.

Work with NDIC to develop new business models.

MOD Grand Challenge